

**CSS Long Term Control Plan
Update Alternatives**



Alternatives Evaluation: Sewer Separation

**City of Alexandria, VA
Department of Transportation and Environmental Services**

FINAL – October 2015



GREELEY AND HANSEN

Alternatives Evaluation: Sewer Separation

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Executive Summary

Executive Summary

Sewer separation is the conversion of a combined sewer systems into separate stormwater and sanitary sewage collection systems. This alternative prevents sanitary wastewater from being discharged to receiving waters and therefore prevents discharges of pathogenic bacteria and floatables associated with human wastes.

In 2005, the City developed their Combined Sewer Service Area Reduction Plan (ARP), and then amended it in 2013. The ARP provides a road map for separation of storm and/or sanitary sewers during new and redevelopment project within the CSS sewershed, whenever practicable. Over the last 10 years the City has separated more than 46 acres from the combined sewer system (18 acres from the Pendleton area, 9 acres of stormwater from the Royal area, and 19 acres from the King and West area with an additional 8 acres under construction). The ARP is tied to redevelopment projects within the combined sewer area. In order to meet the regulatory timeline, separation would be independent of redevelopment. The evaluation in this technical memorandum assumes a roadmap based on the ARP, however, in order to meet the LTCPU timeline, the separation projects will occur continuously until the basins are fully separated.

In the King and West area (serving CSO outfalls 003 and 004) the existing combined sewer would be converted to storm sewer with new sanitary sewers redirected to the Potomac Yard sanitary sewer. In the Royal area (serving CSO outfall 002) the combined sewers would be converted to storm sewers with proposed new sanitary sewers redirected to the Potomac Interceptor. The Pendleton area (serving CSO outfall 001) considers converting the existing combined sewers to sanitary sewers and construction of new storm sewers.

Separation is the most costly alternative to consider as summarized in Table ES-1. Note that the costs in Table ES-1 include the additional costs of addressing stormwater after separation is complete in order to meet the TMDL reductions from both the Hunting Creek and Chesapeake Bay TMDLs. Full separation will require excavating existing infrastructure in Old Town and would lead to years of disruption, making implementation difficult and a negative impact on the local community.

Table ES-1
Estimated Capital Cost of CSO Separation

CSO Area (cost in millions)	Construction Cost	Project Costs	Wet Weather Improvements	Total Capital Cost
King and West (CSO 003 and 004)	\$55.6	\$19.5	\$37.7	\$112.8
Royal (CSO 002)	\$116.6	\$40.8	\$0	\$157.4

It is recommended separation be moved forward for scoring and ranking relative to the other alternatives.

Alternatives Evaluation: Sewer Separation

Section 1

Section 1 Alternative Description

1.1 Overview

Sewer separation is the conversion of a combined sewer systems into separate stormwater and sanitary sewage collection systems. This alternative prevents sanitary wastewater from being discharged to receiving waters and therefore prevents discharges of pathogenic bacteria and floatables associated with human wastes. The WLA assigned by the Hunting Creek TMDL to meet the City's WQS requires an 80% reduction in bacteria load for CSO-002, and 99% reduction for CSO-003 and 004. The full separation of the CSO areas will eliminate the discharges of sanitary flow and therefore reduce the bacteria loads to the required levels to meet the TMDL. However, when combined sewers are separated, the discharges of stormwater and their pollutant loads will increase and additional control will be required since less stormwater will be captured and treated at the WWTP. New stringent stormwater regulations will require pollutant controls on the stormwater system to comply with other water quality requirements.

In 2005, the City developed their Combined Sewer Service ARP, and then amended it in 2013. The ARP provides a road map for separation of storm and/or sanitary sewers during new and redevelopment project within the CSS sewershed, whenever practicable. The evaluation in this technical memorandum assumes a roadmap based on the ARP, however, in order to meet the LTCPU timeline, the separation projects will occur continuously until the basins are fully separated.

Separation is accomplished by installing a new sanitary sewer and using the old combined sewer as a storm sewer or vice versa, depending on the feasibility on each individual service area. The approach is highly site specific and basin specific. In the King and West area, the existing combined sewer is converted to storm sewer with new sanitary sewers redirected to the Potomac Yard sanitary sewer. In the Royal area plan the combined sewers are converted to storm sewers with proposed new sanitary sewers redirected to the Potomac Interceptor.

The City has three CSS areas that comprise approximately 544 acres (5.5 %) of the City, for the purposes of addressing the goals of the Hunting Creek TMDL only the King and West area and the Royal area will be evaluated as shown in Table 1-1. Portions of the drainage have already been separated or are in the process of being separated (e.g. Payne and Fayette).

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Table 1-1
City of Alexandria CSS Service Areas

CSS Area	Drainage Area (Ac)	Sanitary Acres Separated (Ac)	Area to be Separated for Full Separation (Ac)
King and West Area (CSO-003/004)	118	27 ¹	91
Royal Area (CSO-002)	195	0 ²	195
¹ Nineteen (19) acres from the King and West area has been separated with an additional eight (8) acres under construction.			
² Nine (9) acres of stormwater has previously been separated from the Royal area.			

There are four permitted CSO outfalls that serve the three combined areas:

- Pendleton Street CSO (Outfall 001);
- Royal Street CSO (Outfall 002);
- Duke Street CSO (Outfall 003); and
- Hoofs Run CSO (Outfall 004).

The CSS service areas and their CSO outfalls are located in the Old Town area as shown in Figure 1-1.

Alternatives Evaluation: Sewer Separation

Section 1

**Figure 1-1
CSS Areas**



This alternative technical memorandum evaluates the benefits of complete separation of these CSS areas. The evaluation follows the proposed separation plan presented in the ARP. New separate sanitary systems or new storm sewer systems were proposed parallel to the existing combined sewer system.

Alternatives Evaluation: Sewer Separation

Section 1

Depending on the case the existing combined system piping will be converted either on a storm system discharging to the receiving water or a sanitary system connected to the interceptor system.

1.2 Separation Strategy

1.2.1 King and West Combined Sewer Service Area

The King and West Combined Sewer Service Area is comprised of 118 acres bounded approximately by King, West, Columbus, and Vermont (Figure 1-2). Combined sewage currently makes its way southwest to the intersection of King and West and flows southwest down Peyton to the intersection of Duke and Dangerfield. There is a diversion structure on the south side of this intersection that sends dry weather flows into a siphon under Hooffs Run and from there into the Commonwealth Interceptor. Excess flow is diverted to CSO-004 at the east side of Hooffs Run, approximately 300 feet south of the intersection.

As outlined in the ARP, the overall strategy for separating the King and West area is to divert all sanitary flow to the Potomac Yard Trunk Sewer. The 30-inch Potomac Yard Trunk Sewer generally runs south along North Fayette to Queen Street where it redirects west to North Payne before continuing south. In diverting sanitary sewage to the Potomac Yard Trunk Sewer, the existing combined trunk line is converted into a pure storm sewer. Once the separation is complete, the diversion structure at Hooffs Run could be eliminated and all flows sent directly to the CSO outfall become a storm outfall.

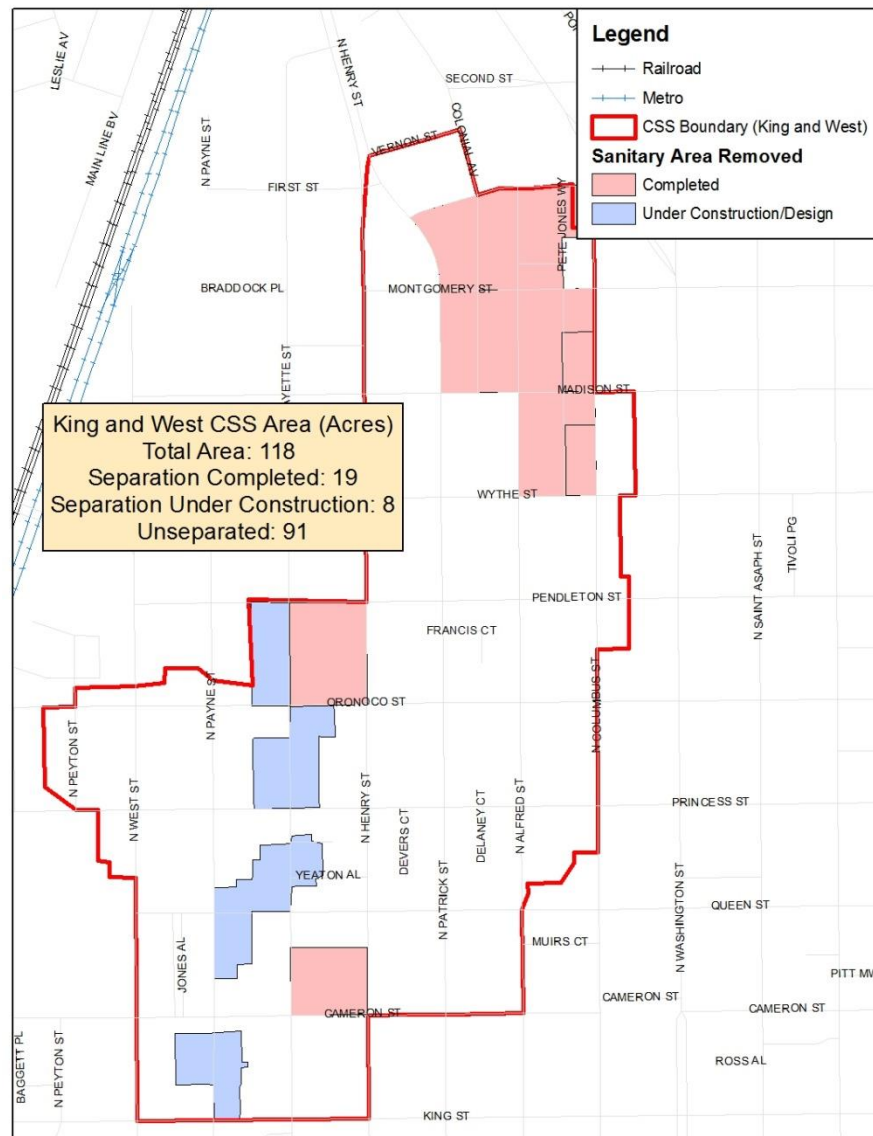
The separation plan primarily includes the construction of new sanitary sewers, and some storm sewer construction. It also ultimately converts the existing combined trunk line into a storm trunk line once all the separation phases are complete. However, until all separation is completed, the bypass structure must remain and CSO volumes will not be noticeably reduced. Sanitary sewage that is diverted from the combined sewer into the Potomac Yard Trunk Sewer will reduce the concentration of CSO discharges until the separation is complete, at which time the CSO outfall will be converted to a storm outfall.

As of 2015, approximately 27 acres has been separated, including 8 acres currently under construction for the Payne and Fayette Sewer Separation Project, leaving 91 acres still to separate.

Alternatives Evaluation: Sewer Separation

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Figure 1-2
King and West Combined Sewer Service Area



1.2.2 Royal Street Combined Sewer Service Area

The Royal Street Combined Sewer Service Area is approximately 195 acres and is located south of the Pendleton Street area and east of the King and West area (See Figure 1-3). Combined wastewater enters two large trunk sewers that flow south along Royal Street to a diversion structure. Dry weather flow is directed to the Potomac Interceptor (downstream of Outfall 001) and combined flow that crests the weir at the diversion structure is directed to Outfall 002.

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Most of the collector sewers in the Royal Street area discharge into a 60-inch combined trunk sewer that runs from the northwest corner of the service area, at Henry and Cameron Streets, southeast to Royal Street. Some of these areas are already predominantly separated, but the flow from their separated lines discharges into the combined sewer further downstream.

As outlined in the ARP, the strategy for separation in the Royal Street area is separating the sanitary flow from the combined sewer wherever possible. With this approach the combined sewer lines are converted to storm sewers. When it was not feasible to convert the combined sewer to storm, it has been converted to a sanitary line by removing all storm flow. In most cases, a storm or sanitary sewer, as required, is run parallel to the converted sewer to convey the flow that was removed from the previously combined sewer. In the areas that are already separated, the flow is redirected so that instead of discharging into the combined sewer, it discharges into the appropriate separated sewer line.

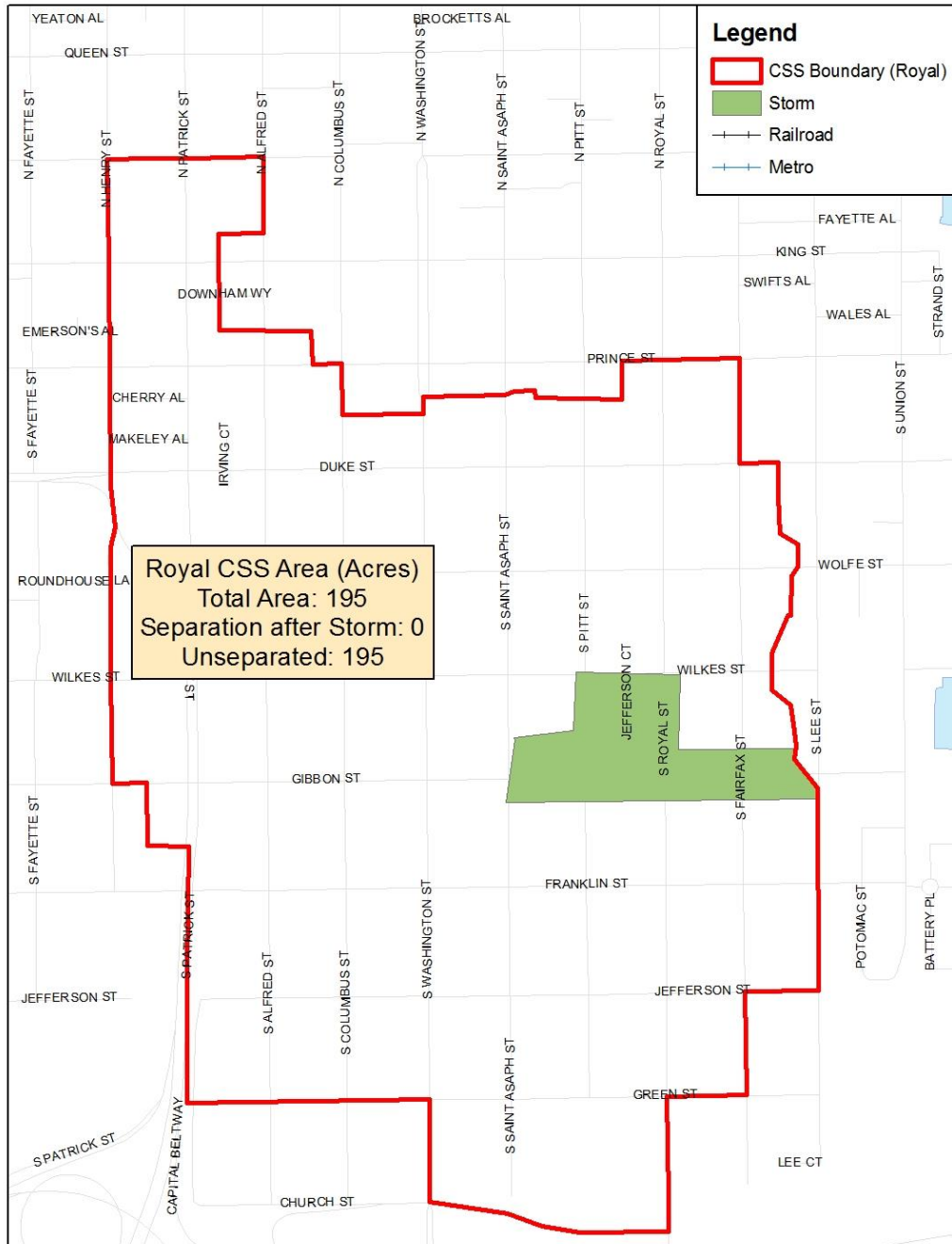
The topography of the Royal Street area dictates that separation begin at the northwest corner of the sewer service area, at the corner of Cameron and Henry Streets and continue southeast to eventually connect to the two trunk sewers that flow south along Royal Street. The existing sanitary trunk sewer will then carry the flow to the Potomac Interceptor, as is the current situation. All sanitary flow will be removed from the existing combined trunk sewer, thus converting it to a storm sewer when it discharges at CSO 002.

As of 2015, approximately 9 acres of storm flow has been separated. Since only a small portion of stormwater has been removed from the combined sewers most of the *E. coli* load remains due to the sanitary connections. Therefore, for the purposes and based on the information above the entire sewershed still needs to be separated for full separation (195 acres). To meet the goals of the TMDL, approximately 195 acres needs to be fully separated.

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Figure 1-3
Royal Combined Sewer Service Area



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Section 1

1.3 New Stormwater System

Due to the way the separation will occur in these areas, the existing combined sewer system and outfalls will be converted to a stormwater system once the system is fully separated. This stormwater system will then fall under the City's MS4 permit and will require the necessary nutrient reduction associated with that per the Chesapeake Bay regulations. By separating the combined areas 118 acres of stormwater from the King and West area and 195 acres of stormwater from the Royal area will be added to the City's MS4 permit.

It is important to note that if the entire sanitary load is removed from the outfalls and only stormwater load is discharged, overall there will be a 78% reduction in the total bacteria load from the King and West area and a 72% reduction in the total bacteria from the Royal area. However, since these outfalls are now stormwater outfalls and no longer CSS outfalls it could be assumed that the City would meet the requirements of the Hunting Creek TMDL to reduce the CSS loads by 99% of the King and West area and 80% of the Royal area. For consistency purposes, a cost to treat the remaining stormwater load is included. Table 1-2 estimates the additional load that will need to be offset if full separation occurs.

Table 1-2
Additional MS4 Load

CSO Area	Area Added to MS4 Permit (ac)	Nitrogen ¹ (lbs/yr)	Phosphorous ¹ (lbs/yr)	TSS ¹ (lbs/yr)
King and West (CSO 003 and 004)	118	1,719	143	98,594
Royal (CSO 002)	195	2,854	239	164,794
¹ Based on the Potomac River pollutant loading rates for Nitrogen, Phosphorous, and Total Suspended Solids from regulated urban pervious and impervious land use categories (Tables 2b in the MS4 General Permit and approximate existing conditions pollutant loading rates as of June 30, 2009).				

Alternatives Evaluation: Sewer Separation

Section 2

Section 2 Evaluation Criteria

The storage tanks alternatives are evaluated based criterion defined in the *Evaluation Criteria Technical Memorandum* and include:

- Cost
- CSO Reduction (CSO Volume)
- Effectiveness
- Implementation Effort
- Impact to the Community
- Expandability
- Net Environmental Benefit
- Nutrient Credits for the Chesapeake Bay TMDL
- Permitting Issues
- Required Maintenance

The *Alternatives Evaluation: Ranking and Recommendation Technical Memorandum* will rank the alternatives based on the above criteria and established weighting. The following sections are provided to illustrate how the individual CSO alternatives will rank.

2.1 Cost

Sewer separation cost were estimated based on the costs generate recently for other local and regional CSO separation projects in major urban areas in the *Basis for Cost Opinions Technical Memorandum*.

2.1.1 Capital

Table 2-1 shows the capital costs of two recent separation projects of CSOs developed for the City of Alexandria and two separation projects for the Washington DC area. The costs vary highly due to particular characteristics of the projects, and the average cost per acre is \$443,000. The two City of Alexandria projects demonstrate the large variability in the cost of separation projects. It should also be noted that the Payne and Fayette Sewer Separation was selected for design and construction based on its relatively low cost and complexity. It is expected the cost will increase dramatically as the complexity of separation projects increase.

Alternatives Evaluation: Sewer Separation

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Table 2-1
Capital Cost of CSO Separation Projects in Alexandria and Washington DC

Location	Project	Drainage Area (ac)	Escalated Capital Cost	Capital \$/ac Escalated
Alexandria, VA	Taynard Ditch	11.5	\$9,388,477	\$816,389
Alexandria, VA	Payne and Fayette	7.41	\$1,042,468	\$140,684
Washington, DC	Anacostia CSO 006	13.56	\$3,319,404	\$244,794
Washington, DC	Rock Creek CSO 031, 037, 053 and 058	28.46	\$13,212,452	\$464,246
Weighted Average				\$443,000

The capital costs for the separation of the combined sewer sheds are shown in Table 2-2.

There is project, independent of the LTCPU, currently under consideration by the City, AlexRenew, and Fairfax County to provide wet weather improvement, address basement backups during large wet weather events, as well other benefits for the King and West sewer shed (CSOs 003 and 004). Unlike other alternatives (i.e. tunnels), these wet weather improvements cannot be addressed through separation alone. In order to normalize the cost of the alternatives, the estimated capital costs of these wet weather improvements are included for the King and West area.

Table 2-2
Estimated Capital Cost of CSO Complete Separation

CSO Area (cost in millions)	Construction Cost	Project Costs	Wet Weather Improvements	Total Capital Cost
King and West (CSO 003 and 004)	\$55.6	\$19.5	\$37.7 ¹	\$112.8
Royal (CSO 002)	\$116.6	\$40.8	\$0	\$157.4
¹ Select wet weather improvements, including hydraulic grade line control structure, AlexRenew WRRF upgrades and the wet weather pump station will be shared facilities with Fairfax County. The cost split for these shared facilities will be determined at a later date				

2.1.2 Stormwater (MS4) Costs

Fully separating the sanitary sewers in the combined sewer system will convert the existing CSOs to stormwater outfalls. Due to this change, the area associated with the combined sewer system will become part of the stormwater system and will then fall under the City's MS4 Permit. This means that there will now be new costs associated with treating this area to meet the requirements of the MS4 Permit. A 20-year present worth cost is estimated for each parameter (N/P/TSS) based on planning level unit costs for removing the parameter through a new stormwater BMP. Planning level unit costs vary widely and are highly site specific; however, for the purposes of this evaluation unit costs of \$6,000/lb for nitrogen,

Alternatives Evaluation: Sewer Separation

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\$25,000/lb for phosphorous, and \$80/lb for TSS are assumed based on the range of costs provided in the *Cost-Effectiveness Study of Urban Stormwater BMPs in the James River Basin* (2013) completed by the Center for Watershed Protection. The parameter with the highest cost is assumed to be the controlling parameter. These costs and loads are estimated and presented below.

CSO Area	Area Added to MS4 Permit (ac)	Nitrogen (lbs/yr)	Phosphorous (lbs/yr)	TSS (lbs/yr)	Estimated PW Cost to Treat (\$M)
King and West (CSO 003 and 004)	118	1,719	143	98,594	\$10.3
Royal (CSO 002)	195	2,854	239	164,794	\$17.1

2.2 CSO Reduction (CSO Volume)

Once fully separated, outfalls 002, 003 and 004 will become storm outfalls. As such there is a 100% reduction in CSO volume and the regulatory burden is transferred from the CSO permit to the City's MS4 permit.

CSO Reduction Rating	Description	Rating
Very High	>95% reduction	X
High	Reduction 75-95%	
Medium	Reduction 50-74%	
Low	Reduction 25-49%	
Minimal (or none)	<25% reduction	

2.3 Effectiveness

The effectiveness is based on how well each alternative reduces the bacterial input to the receiving waters. The effectiveness of each alternative is based on the amount of bacterial load that is removed at each discharge location. It is important to note that the stormwater load will remain, so fully removing the sanitary load from an outfall will not result in 100% of the bacterial load being removed.

CSO Area	Comparison Year	<i>E. coli</i> Load Reduction ¹	Rating
King & West (CSO 003 and 004)	1984	78%	Medium
Royal (CSO 002)	1984	72%	Medium

¹ Reduction based only on separation and does not include stormwater BMPs.

Alternatives Evaluation: Sewer Separation

Section 2

2.4 Implementation Effort

Full separation requires digging up the infrastructure in Old Town and would lead to years of disruption. Assuming an implementation timeline starting in 2018 and finishing in 2035, the Old Town area will average 18 acres of active construction each year. This is the equivalent to approximately 7-8 square blocks continuously under construction.

	King and West (CSO 003 and 004)	Royal (CSO 002)
Are construction projects low in complexity or utilize commonly implemented technology?	No	No
Is land available in the proposed project areas?	Yes	Yes
Are there adequate amount of resources, labor, and expertise to complete projects?	Yes	Yes
Can the proposed project(s) be reasonably constructed in the highly urban environment of Old Town Alexandria? ¹	No	No
Is it likely the LTCP deadlines will be met? ¹	No	No
Rating	Low	Low

¹ While there is the expertise and resources available to perform separation, it may not be possible to complete the full separation within the Permit deadline of 2035.

Alternatives Evaluation: Sewer Separation

Section 2

2.5 Impact to the Community

The impact of separation on residents and business will be severe. Separation will require digging up the infrastructure in Old Town. The associated disruption includes street closures, sidewalk closures, construction noise, construction dust, and utility outages. Access to residential properties and commercial properties during construction will be negatively impacted. Closing streets during construction could result in lost revenue for businesses that are the economic driver for the City. Additionally parking spaces will be lost during construction making it harder for potential patrons to visit these businesses.

Impact on Business and Public Rating	Description	Rating
High	Improved quality of life and minimal negative impact during implementation	
Medium	Some negative impact during implementation	
Low	Excessive negative impact during implementation	X

2.6 Expandability

The progressive approach of separation provides good opportunities for expansion. Once a basin is fully separated there is no need for further expansion.

Expandability Rating	Description	Rating
High	Multiple options and space for expansion	X
Medium	Few options and space for expansion	
Low	Limited options and space for expansion	
Minimal (or none)	No opportunities for expansion	

Alternatives Evaluation: Sewer Separation

Section 2

2.7 Net Environmental Benefit

The net environmental benefit is based on each alternative's Envision base score. More information about this ranking can be found in the *Evaluation Criteria Technical Memorandum*.

Net Environmental Benefit Rating	Envision Checklist Score	Rating
Very High	Base score + >35	
High	Base score + 26-35	
Medium	Base score + 16-25	
Low	Base score + 6-15	X
None	Base score + 0-5	

2.8 Nutrient Credits for the Chesapeake Bay TMDL

There is no opportunity to generate nutrient or sediment credits for the Chesapeake Bay TMDL for the separation alternative and additional stormwater loadings that apply to the City's stormwater MS4 permit are generated.

2.9 Permitting Issues

The separation alternative is given a moderate risk for permitting issues. While there no major permits required, separation will require various construction permits that will continuously need to be requested and maintain for each individual project, including, but not limited to: the Virginia Stormwater Management Program (VSMP), noise permits, and traffic permits.

Permitting Issues Rating	Description	Rating
High	Minimal risk of permit issues	
Medium	Moderate risk of permit issues	X
Low	Significant risk of permit issues	

Alternatives Evaluation: Sewer Separation

Section 2

2.10 Required Maintenance

No significant change to the City's operation and maintenance procedures are necessary due to sewer separation.

Requirement Maintenance Rating	Description	Rating
High	Few and infrequent maintenance	X
Medium	Frequent maintenance	
Low	Frequent and expensive	

2.11 Net Present Worth

Since there is no significant change to the City's operation and maintenance costs, the net present value is equal to the capital costs and the cost of addressing the additional area added to the MS4 permit.

CSO Area (cost in millions)	Construction Cost	Project Costs	MS4 Costs	Wet Weather Improvements	Total NPW Cost
King and West (CSO 003 and 004)	\$55.6	\$19.5	\$10.3	\$37.7	\$123.1
Royal (CSO 002)	\$116.6	\$40.8	\$17.1	N/A	\$174.6

2.12 Recommendation for Alternative Scoring

The separation alternatives are unfavorable and are likely impractical due to the extraordinarily high capital costs and the significant and continuous disruption to the City residents throughout the CSS area. However, it is recommended the Separation Alternative be included in the alternative scoring and ranking relative to the other alternatives.

Alternatives Evaluation: Sewer Separation

Section 3

Section 3 Opportunities for Synergy with Other Technologies

Full sewer separation will result in the conversion of a combined sewer system to separate stormwater and sanitary sewer systems. Thus, no other combined sewer controls would be required. However, it may be infeasible to separate all of the combined sewer system. As outlined in the ARP, separation, when tied to redevelopment in the City, can be an effective complementary strategy. Over time, as separation occurs, the bacteria concentration associated with each overflow is expected to decrease. As this concentration declines the overall load associated each overflow will also decrease.

Alternatives Evaluation: Sewer Separation

Section 4


Section 4 Additional Investigation Needs

If the separation alternative is retained the following additional investigations should be considered:

- Develop a detailed phasing and implementation plan; and
- Monitor ongoing separation projects for construction pricing trends.

Alternatives Evaluation: Sewer Separation

Attachment A



Attachment A

Separation Alternative Cost Estimates

**COA LTCPU
Separation Summary**

Date: 10-Apr-15
Prepared By: J. McGettigan
Checked By: C. Wilber
Rounding: 3 Digits

Area	Construction Cost	Project Costs	Storm Water (MS4) Costs	Wet Weather Improvements	Total
King and West	\$55.6	\$19.5	\$10.3	\$37.7	\$123.1
Royal	\$116.6	\$40.8	\$17.1	\$0.0	\$174.6
Pendleton	\$148.6	\$52.0	\$20.9	\$0.0	\$221.5

COA LTCPU
King and West

Alternative King and West Separation
Date: 10-Apr-15
Prepared By: J. McGettigan
Checked By: C. Wilber

[illegible]

Table 2: Stormwater Nutrient and Sediment Costs

Item	QTY	Units	Unit Cost	Total	Comments
Total Acres	118.0	acres			
Impervious	78.2	acres			
Pervious	39.8	acres			
Total Suspended Solids					
Impervious Loading Rate (2009 EOS)	1171.32	lbs/acre			Table 2B of the MS4 GP
Pervious Loading Rate (2009 EOS)	175.8	lbs/acre			Table 2B of the MS4 GP
Load	98,594	lbs/yr	\$80	\$ 7,887,525	
Nitrogen					
Impervious Loading Rate (2009 EOS)	16.86	lbs/acre			Table 2B of the MS4 GP
Pervious Loading Rate (2009 EOS)	10.1	lbs/acre			Table 2B of the MS4 GP
Load	1719	lbs/yr	\$6,000	\$ 10,315,428	
Phosphorous					
Impervious Loading Rate (2009 EOS)	1.62	mg/L			Table 2B of the MS4 GP
Pervious Loading Rate (2009 EOS)	0.4	mg/L			Table 2B of the MS4 GP
Load	143	lbs/yr	\$25,000	\$ 3,575,050	
Net Present Worth (Max of TSS/N/P)				\$ 10,315,428	

COA LTCPU
Royal

Alternative Royal Area Separation
Date: 10-Apr-15
Prepared By: J. McGettigan
Checked By: C. Wilber

Item	QTY	Units	Unit Cost	Total	Comments
Royal Area to Separated (100%)	195	ac	\$443,000	\$86,385,000	Local Bid Data
<i>Subtotal</i>				<i>\$86,385,000</i>	
Construction Contingency	35%			<u>\$30,235,000</u>	
<i>Construction Subtotal</i>				<i>\$116,620,000</i>	
Planning, Design, CM, Administration, Permitting and Easements	35%			\$40,817,000	
Total Project				\$157,437,000	

Table 2: Stormwater Nutrient and Sediment Costs

Item	QTY	Units	Unit Cost	Total	Comments
Total Acres	195.0	acres			
Impervious	131.1	acres			
Pervious	63.9	acres			
Total Suspended Solids					
Impervious Loading Rate (2009 EOS)	1171.32	lbs/acre			Table 2B of the MS4 GP
Pervious Loading Rate (2009 EOS)	175.8	lbs/acre			Table 2B of the MS4 GP
Load	164,794	lbs/yr	\$80	\$ 13,183,494	
Nitrogen					
Impervious Loading Rate (2009 EOS)	16.86	lbs/acre			Table 2B of the MS4 GP
Pervious Loading Rate (2009 EOS)	10.1	lbs/acre			Table 2B of the MS4 GP
Load	2854	lbs/yr	\$6,000	\$ 17,122,914	
Phosphorous					
Impervious Loading Rate (2009 EOS)	1.62	mg/L			Table 2B of the MS4 GP
Pervious Loading Rate (2009 EOS)	0.4	mg/L			Table 2B of the MS4 GP
Load	239	lbs/yr	\$25,000	\$ 5,964,525	
Net Present Worth (Max of TSS/N/P)				\$ 17,122,914	

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